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JAPANESE PATENT OFFICE

## PATENT ABSTRACTS OF JAPAN

(11) Publication number: **06008889 A**(43) Date of publication of application: **18.01.94**

(51) Int. Cl.

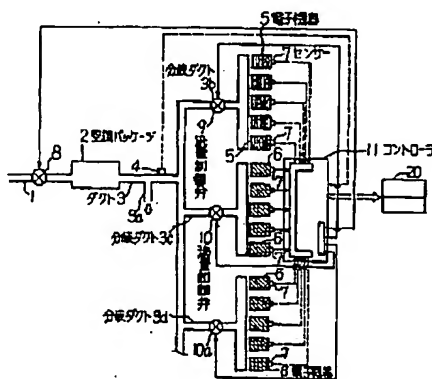
**B64D 13/08**(21) Application number: **04170627**(71) Applicant: **MITSUBISHI HEAVY IND LTD**(22) Date of filing: **29.06.92**(72) Inventor: **TAKAO TAKASHI**(54) **COOLING-AIR DISTRIBUTING DEVICE TO  
ELECTRONIC EQUIPMENT**

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(57) Abstract:

**PURPOSE:** To obtain a cooling air distributing device which supplies the cooling air having a flow rate necessary for the electronic equipment mounted on an aircraft and does not require the reconstruction of the device even after the addition and repair of the electronic device.

**CONSTITUTION:** A cooling air distributing device is equipped with a plurality of ducts 3b, 3c and 3d which distribute the cooling air to electronic devices 5 and 6 from an air conditioner 2, flow rate control valves 9, 10 and 10a which are installed on the respective ducts and can vary the opening degree, sensor 7 for monitoring the operation state of each electronic device 5, 6, and a controller 11 which receives the signal of the sensor 7 and outputs the signal for controlling the opening degree of each flow rate control valve 9, 10, 10a on the basis of the signal input. Accordingly, the necessity of an orifice on the device is obviated.



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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the cooling air distribution apparatus to electronic equipment, such as an aircraft.

[0002]

[Description of the Prior Art] Drawing 2 and drawing 3 explain the cooling air distribution apparatus to the electronic equipment of the conventional aircraft. Among drawing 2, the orifice of the upstream by which an air-conditioning package a, and c was prepared for a in Duct b, and e are aircraft loading electronic equipment, and cooling air is supplied from said duct b through the orifice d by the side of an end.

[0003] The orifice c of the upstream prepared in said duct b is shown in drawing 3, and this orifice c reduces to it the cross section which annular members prepared in Duct b are consisted of, and cooling air passes.

[0004] With this equipment, the cooling air cooled with the air-conditioning package a is adjusted by the flow rate which a down-stream network needs by the orifice c of the upstream in the duct b of cooling air, and is distributed to a flow rate required for forced cooling of the loading electronic equipment e by the orifice d by the side of an end. The aforementioned orifices c and d are changed by the addition of the electronic equipment of the aircraft, repair, etc.

[0005]

[Problem(s) to be Solved by the Invention] In the distribution apparatus of the conventional cooling air shown in said drawing 2 and drawing 3, there was a problem of being obliged to redesign of a cooling air distribution network at the addition of the loading electronic equipment of the aircraft, and every modification for the following reasons.

(1) Since the need cooling air flow of the downstream changed by the additional size rise of the duct by the addition of electronic equipment, and modification etc., depending on adjustment of the orifice c of not only the bore diameter of the orifice d by the side of an end but the upstream, and the case, it needed to be an addition.

(2) Moreover, when the flow rate of the cooling air needed by the downstream according to each employment conditions of two or more loading electronic equipment changed a lot, it was not able to respond.

[0006] This invention tends to solve the above problem and tends to offer the cooling air distribution apparatus to the electronic equipment which does not need redesign to the addition of electronic equipment, modification, etc.

[0007]

[Means for Solving the Problem] In the cooling air distribution apparatus to the electronic equipment which this invention distributes cooling air from an air-conditioning machine to two or more electronic equipment, and is supplied A flow control valve with the opening stranger good than an air-conditioning machine prepared in each of two or more ducts which distribute and supply cooling air to electronic equipment, and two or more of said ducts, The signal of the sensor which acts as the monitor of the operating state of each of said electronic equipment, and said sensor is inputted, and it is characterized by having the controller which outputs the signal which controls the opening of the \*\*\*\*\* aforementioned flow control valve to this to a flow control valve.

[0008]

[Function] The cooling air distribution apparatus to the electronic equipment of this invention is constituted as mentioned above, the signal of the sensor which acts as the monitor of the busy condition of each electronic equipment is inputted into a controller, and the opening of the flow control valve of each duct is controlled by the signal from a \*\*\*\*\* controller by this. The cooling air of a required flow rate is supplied to each electronic equipment by this.

[0009]

[Example] Drawing 1 explains one example concerning the cooling air distribution apparatus of the aircraft loading electronic equipment of this invention.

[0010] 1 is the duct of the high-pressure air from the engine of the aircraft, and this duct 1 is connected to the air-conditioning package 4 through the flow control valve 8 adjustable in opening. This air-conditioning package 4 is equipped with an expansion means to make the high-pressure air which radiated heat by the heat exchanger which radiates heat in the high-pressure air from said engine, and this heat exchanger lower further. 3 is the duct of the air cooled with the air-conditioning package 2, and the pressure sensor 4 is formed.

[0011] Are the electronic equipment which always uses 5, and electronic equipment which uses 6 temporarily, and the plurality (in illustration, they are five pieces) of said electronic equipment 5 constitutes one group. Two groups constituted by the plurality of said electronic equipment 6 are prepared (when it is illustration, each class consists of five electronic equipment). To each of one group of electronic equipment 5, and two groups of electronic equipment 6 Cooling air is supplied with the branching ducts 3b, 3c, and 3d connected to said duct 3, respectively. 9, 10, and 10a are flow control valves adjustable in the opening prepared in said branching ducts 3b, 3c, and 3d, respectively.

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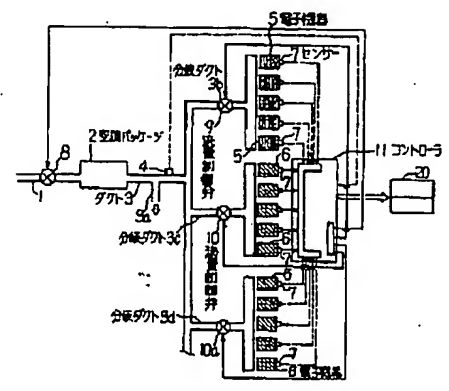
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[0011] Are the electronic equipment which always uses 5, and electronic equipment which uses 6 temporarily, and the plurality (in illustration, they are five pieces) of said electronic equipment 5 constitutes one group. Two groups constituted by the plurality of said electronic equipment 6 are prepared (when it is illustration, each class consists of five electronic equipment). To each of one group of electronic equipment 5, and two groups of electronic equipment 6 Cooling air is supplied with the branching ducts 3b, 3c, and 3d connected to said duct 3, respectively. 9, 10, and 10a are flow control valves adjustable in the opening prepared in said branching ducts 3b, 3c, and 3d, respectively.

[0012] The sensor 7 which acts as the monitor of the operating state is formed in each of said electronic equipment 5 and 6, and the signal and signal of said pressure sensor 4 are inputted into a controller 11. A controller 11 outputs the signal which controls the opening of the \*\*\*\*\* aforementioned flow control valves 8, 9, 10, and 10a from said sensor 7 to a signal to each flow control valves 8, 9, 10, and 10a.

[0013] 3a is a duct which branches from a duct 3 by the upstream of a pressure sensor 4, and supplies cooling air to CABIN, and a controller 11 transmits the condition of each electronic equipment 5 and 6 to the caution light 20 of a cockpit.

[0014] In addition, the 4 modes of MAX, NORMAL, STAND, and OFF are given to the operating state of each of said electronic equipment 5 and 6.

[0015] The control law of each flow control valve by said controller 11 in this example is as follows. •

[0016] The flow control valve 9 which passes cooling air to electronic equipment 5 is always opened, and, as for the flow control valves 10 and 10a which pass cooling air to electronic equipment 6, it is opened only at the time of use. Moreover, said each flow control valve is doubled with the flow rate of the device in the highest mode in the electronic equipment of the lower stream of a river, and closing motion is adjusted. When the air-conditioning package 2 breaks down, the flow control valves 10 and 10a passed to the electronic equipment 6 which carries out chisel use temporarily are closed.

[0017] Moreover, acting as the monitor of the pressure of the cooling air sent to electronic equipment 5 and 6 with a pressure sensor 4, the opening of a flow control valve 8 is adjusted so that the minimum discharge according to the mode of electronic equipment 5 and 6 may be passed.

[0018] In this example, it acts as a monitor by the sensor 7, and the signal is inputted into a controller 11, and the operating mode of each electronic equipment 5 and 6 outputs the signal which controls the opening of the \*\*\*\*\* flow control valve 8 to the signal of said sensor 4 in addition to the signal of said sensor 7, while outputting the signal which controls the opening of \*\*\*\*\* each flow control valves 9, 10, and 10a to this in a controller 11.

[0019] Therefore, the air of a flow rate required for cooling of electronic equipment 5 and the 6 whole is supplied to the air-conditioning package 2 by control of the opening of a flow control valve 8. The air cooled with the air-conditioning package 2 will be distributed so that a flow demand may be supplied to the group of electronic equipment 5 and 6 by controlling the opening of flow control valves 9, 10, and 10a as mentioned above, and each electronic equipment 5 and 6 will be effectively cooled by this air.

[0020] Moreover, in this example, since distribution of a flow rate are adjusted and the orifice is not used like conventional equipment by flow control valves 9, 10, and 10a, even if it performs addition of electronic equipment, repair, etc., it is not necessary to repair equipment each time. Furthermore, since the cooling air of the minimum flow rate doubled with the operating mode of electronic equipment 5 and 6 can be supplied to each electronic equipment 5 and 6, consumption of the high-pressure air from an engine can be made into the minimum, and the power consumption of the air-conditioning package 2 can be stopped, and degradation can be suppressed for an engine performance.

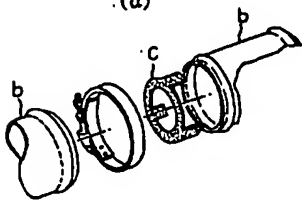
[0021] In addition, although said example starts the cooling air distribution apparatus of the electronic equipment of the aircraft, this invention is widely applicable to the cooling air distribution apparatus of electronic equipment other than the aircraft.

[0022]

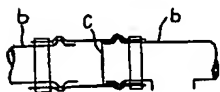
[Effect of the Invention] As aforementioned, the cooling air distribution apparatus to the electronic equipment of this invention outputs a signal to a signal from a \*\*\*\*\* controller from the sensor which acts as the monitor of the operating state of each electronic equipment, and is controlling the flow control valve of two or more ducts which distribute and supply cooling air to electronic equipment by this. Therefore, the cooling air of a flow rate required for each electronic equipment is supplied, and effective cooling can be performed.

[0023] Moreover, since the flow rate of cooling air is adjusted by the flow control valve also in case addition of electronic equipment, repair, etc. are performed, repair of equipment is not needed. Furthermore, since a flow control valve can be adjusted so that the minimum discharge doubled with the operating state of electronic equipment may be passed, consumption of air can be made into the minimum and the power consumption of an air-conditioning machine can be stopped.

(a)

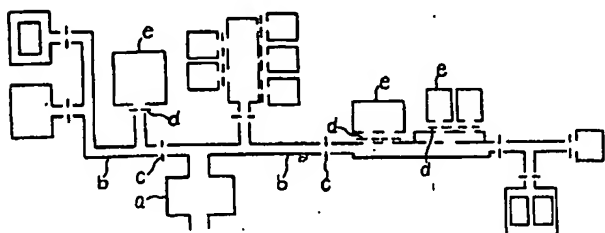


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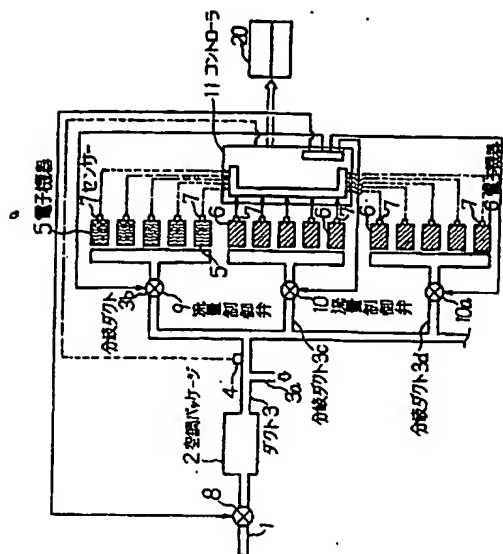
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